Citation:

Williams P. Breakfast and the diets of Australian adults: An analysis of data from the 1995 National Nutrition Survey. *Int J Food Sci Nutr*. 2005; 56 (1): 65-79.

PubMed ID: 16019316

Study Design:

Cross-sectional study

Class:

D - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

- To assess the nutrients provided to Australian adults by the breakfast meal
- To compare the food and nutrient intakes and health of regular breakfast eaters and breakfast skippers.

Inclusion Criteria:

A nationally representative sub-sample (adult Australians, aged 19 or more years) of the National Health Survey.

Exclusion Criteria:

National Health Survey participants younger than 19 years old.

Description of Study Protocol:

Recruitment

A nationally representative sample of 10,851 Australians, aged 19 years and older, from the 1995 Australian National Nutrition Survey (NNS), during the period between February 1995 and March 1996.

Design

Cross-sectional study (population-based data).

Dietary Intake/Dietary Assessment Methodology

- A 24-hour recall: Indicated the intake of food items on the day prior to the interview (i.e., the day of recall)
- A food frequency questionnaire (FFQ): Used to assess the intake of selected foods, including nutrient supplements, over the previous 12 months
- A series of questions: Asked and included self-reported health status on a five-point scale and "How many days per week do you usually have something to eat at breakfast?"

Blinding Used

Physical measurements were taken of height, weight, waist and hip circumference and blood pressure.

Statistical Analysis

The Student T-test was used to calculate statistical significance of differences between breakfast eaters and breakfast skippers and between eaters and non-eaters of breakfast cereal.

Data Collection Summary:

Timing of Measurements

Data collected from the 1995 Australian NNS during the period between February 1995 and March 1996.

Dependent Variables

- Nutrient intake: Calculated using the 24-hour recall data in the Confidential Unit Record File, which included food intakes for each individual surveyed. A food composition database developed by the Australia New Zealand Food Authority (1999) was used to calculate nutrient intakes
- Food and nutrient intakes: Compared with current recommended dietary intakes (RDI) for use in Australia (National Health and Medical Research Council 1991) or other dietary target recommendations
  - The recommended target of 30g dietary fibre per day for adults aged 19 years or older
  - Servings of cereal foods calculated by dividing the food intake (grams) by the standard cereal serves defined for the Australian Core Food Groups (30g for bread, 20g for RTEC and 90g for cooked rice, pasta or porridge)
  - Intakes compared with the target of seven serves per day for adults aged 19 years or older
  - The dietary target of 55% of energy from carbohydrate taken from the recommendations of the Food and Agriculture Organization/World Health Organization (WHO) expert consultation on carbohydrates
- Health status: Self-reported on a five-point scale.

Independent Variables

- Eaters and skippers: Participants were asked how many days per week they usually had something to eat at breakfast
- Those who indicated they ate breakfast five or more days a week were classified as regular breakfast eaters; those who responded "rarely or never" were classified as breakfast skippers.

Control Variables

- Age:
  - 19 to 24 years
  - 25 to 44 years
  - 45 to 54 years
  - 45 to 64 years
  - 55 or more years
  - 65 or more years
- Gender: Male and female.

Description of Actual Data Sample:

- *Initial N:* 13,858 National Health Survey participants aged two years and over from urban and rural areas in all States and Territories from Australia
- *Attrition (final N):* After applying for the exclusion criteria, 10,851 individuals aged 19 years or older were included in the analysis
- *Age:* 19 years or older
- *Anthropometrics:* People from urban and rural areas
- *Location:* All States and Territories from Australia.

Summary of Results:

Table I. Median nutrient intake of Australian adult males from breakfast and the percentage contribution to total daily intake.

	19-24 years	25-44 years	45-64 years	65+ years

	Median	Standard error	%	Median	Standard error	%	Median	Standard error	%	Median	Standard error	%
Energy (kJ)	1629	81	12.7	1400	60	12.6	1537	28	15.6	1733	41	20.9
Protein (g)	12.4	1.3	10.4	11.5	0.6	10.9	13.8	0.3	14.1	14.5	0.4	18.1
Fat (g)	9.8	0.7	8.8	8.1	0.4	8.4	9.6	0.5	11.4	10.5	0.4	15.3
Carbohydrate (g)	53.2	3.8	15.0	47.8	1.5	16.1	53.1	1.3	20.1	60.8	2.0	26.5
Sugar (g)	18.0	2.9	11.2	18.0	2.9	14.6	20.0	0.6	18.5	28.2	0.9	26.7
Dietary fibre (g)	2.4	0.3	10.0	2.9	0.1	12.2	4.1	0.2	16.7	5.3	0.2	23.5
Thiamin (mg)	0.52	0.05	26.0	0.40	0.03	23.5	0.45	0.02	28.1	0.50	0.02	35.7
Riboflavin (mg)	0.55	0.08	22.9	0.41	0.05	19.5	0.54	0.02	27.0	0.68	0.04	37.8
Niacin (mg)	7.95	0.49	14.7	6.72	0.25	13.5	7.67	0.23	16.4	7.58	0.23	20.5
Folate (mg)	41.4	4.0	13.6	36.4	1.5	12.8	47.3	1.6	16.1	55.5	2.1	21.6
Vitamin A (RE)	94.5	7.1	9.0	75.2	4.4	8.3	92.9	3.8	9.8	99.4	4.5	10.7
Vitamin C (mg)	2.5	0.3	2.6	1.5	0.2	1.5	2.0	0.2	1.8	3.0	0.2	2.8
Calcium (mg)	161	16	16.7	145	7	16.5	185	10	23.4	227	8	31.0
Iron (mg)	2.0	0.20	11.8	2.2	0.13	14.5	3.1	0.11	20.3	3.5	0.10	25.5
Magnesium (mg)	52.0	4.4	14.3	54.0	2.0	14.7	69.3	2.8	18.8	82.2	2.3	25.4
Zinc (mg)	1.4	0.14	9.3	1.4	0.07	10.6	1.7	0.05	13.6	1.9	0.07	13.9
Phosphorus (mg)	250	22	13.3	234	12	13.5	301	10	18.7	326	11	24.2
Potassium (mg)	428	44	11.7	425	17	11.9	514	16	14.3	604	25	19.6

Table II. Median nutrient intakes of Australian adult females from breakfast and the percentage contribution to total daily intake.

	19-24 years			25-44 years			45-54 years			55+ years		
	Median	Standard error	%	Median	Standard error	%	Median	Standard error	%	Median	Standard error	%
Energy (kJ)	1051	43	13.3	1056	27	14.0	1099	24	15.8	1211	20	19.8
Protein (g)	8.6	0.7	11.7	8.8	0.2	12.3	9.5	0.4	13.6	10.8	0.2	17.7
Fat (g)	5.5	0.6	8.2	5.9	0.2	8.9	5.5	0.2	9.2	6.8	0.2	13.3
Carbohydrate (g)	37.9	2.2	16.6	37.2	0.8	17.7	39.2	1.0	20.7	43.0	0.8	25.0
Sugar (g)	13.9	1.4	13.0	13.3	0.7	14.9	15.2	0.9	18.4	18.6	0.5	23.0
Dietary fibre (g)	2.0	0.2	11.5	2.7	0.1	14.6	2.3	0.2	11.5	4.2	0.1	21.8
Thiamin (mg)	0.26	0.03	21.6	0.28	0.01	23.3	0.34	0.02	28.3	0.38	0.01	34.5
Riboflavin (mg)	0.34	0.06	22.7	0.32	0.03	21.3	0.41	0.03	25.6	0.53	0.02	35.3
Niacin (mg)	4.43	0.37	13.4	5.11	0.13	15.2	5.43	0.23	16.6	5.92	0.17	20.9
Folate (g)	27.7	2.5	12.8	32.2	0.8	15.3	35.6	1.9	15.7	45.6	1.2	20.9
Vitamin A (RE)	49.8	5.6	6.7	55.8	2.7	7.8	50.8	2.9	6.3	70.2	2.8	8.9
Vitamin C (mg)	1.3	0.2	1.8	1.3	0.1	1.7	1.5	0.1	1.6	2.6	0.1	2.8
Calcium (mg)	115	14	16.9	121	5	16.9	147	7	21.2	189	6	30.5
Iron (mg)	1.5	0.17	14.1	1.8	0.07	16.2	2.3	0.09	19.8	2.7	0.07	25.0
Magnesium (mg)	40.0	3.3	16.2	46.1	1.3	17.3	54.4	3.0	19.3	69.5	2.0	26.9
Zinc (mg)	1.0	0.09	11.1	1.1	0.05	12.2	1.2	0.06	13.3	1.5	0.04	19.0
Phosphorus (mg)	168	14	13.7	179	7	14.6	211	13	17.1	258	6	24.0
Potassium (mg)	331	39	13.1	357	12	13.3	408	19	14.5	483	11	18.6

Table III. Percentage of recommended dietary intake (National Health and Medical Research Council, 1991) or dietary target (fibre, 30 g/day; Better Health Commission, 1986) obtained from breakfast.

	19-24 years		25-44 years		45-64 years		45-54 years		65+ years		55+ years		All adults 19+ years	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females			Males	Females
Protein	28.7	23.4	26.0	23.3	27.2	24.2	28.4	26.6	27.1	24.8				
Dietary fibre	14.3	11.6	16.1	12.8	19.1	15.5	22.7	18.6	17.7	15.9				
Thiamin	66.2	59.6	54.1	54.1	51.3	53.0	69.2	67.5	57.1	56.3				
Riboflavin	58.7	54.4	47.9	49.6	44.0	48.1	64.9	64.9	54.0	55.2				
Niacin equivalents	50.2	48.2	44.8	47.9	44.1	48.3	53.9	61.3	46.7	53.7				
Folate	27.6	20.8	24.9	20.9	28.2	23.1	28.2	26.7	26.7	23.7				
Retinol equivalents	32.7	16.4	22.8	15.4	21.3	13.3	22.8	16.3	26.5	15.6				
Vitamin C	70.3	61.2	48.4	56.7	49.3	58.3	52.9	67.2	53.3	61.9				
Calcium	34.3	23.3	29.9	23.0	29.8	25.0	34.3	22.1	31.1	22.9				
Iron	57.5	19.8	54.8	20.6	57.1	21.8	62.4	55.7	57.0	35.8				
Magnesium	22.6	20.3	23.5	22.1	26.9	25.9	31.3	30.9	25.5	26.4				
Zinc	16.0	10.6	14.9	11.1	16.0	12.0	18.1	14.4	15.7	11.5				
Phosphorus	34.4	23.6	31.8	23.6	33.4	26.1	37.4	30.0	33.4	26.7				

Table IV. Comparison of the mean daily nutrient intakes of Australian adult breakfast eaters and skippers*.

	All males 19+ years			All females 19+ years		
	Eaters	Skippers	P	Eaters	Skippers	P
Energy (kJ)	11193	10453	0.001	7405	6814	0.001
Protein (g)	110	104	0.000	74	66	0.029
Fat (g)	99	95	0.231	66	64	0.138
Carbohydrate (g)	310	266	0.001	210	184	0.022
Sugar (g)	139	121	0.060	96.6	85.1	0.078
Dietary fibre (g)	27.5	20.8	0.000	21.3	15.5	0.000
Thiamin (mg)	2.1	1.6	0.000	1.4	1.0	0.000
Riboflavin (mg)	2.3	1.7	0.000	1.9	1.3	0.000
Niacin (mg)	51.4	48.1	0.020	34.2	29.7	0.001

Folate (g)	319	272	0.005	242	186	0.000
Vitamin A (RE)	1360	1181	0.050	1083	1166	0.033
Vitamin C (mg)	144	113	0.000	120	84	0.000
Calcium (mg)	993	792	0.000	768	614	0.000
Iron (mg)	17.2	13.8	0.000	12.3	9.3	0.000
Magnesium (mg)	396	332	0.000	292	232	0.000
Zinc (mg)	14.4	14.0	0.076	9.9	8.4	0.030
Phosphorus (mg)	1824	1593	0.001	1289	1079	0.000
Potassium (mg)	3821	3381	0.005	2884	2331	0.000

*Eaters had breakfast five or more days/week; skippers ate breakfast rarely or never.

Table V. Breakfast eating and self-reported health status of adults (percentage of breakfast eaters and skippers)

Health status	Eaters	Skippers	P
Excellent	19.8	16.4	0.002
Very good	37.5	36.5	0.468
Good	27.2	31.4	0.015
Fair	12.0	12.7	0.388
Poor	3.6	3.1	0.340

Other Findings

- Figures showed that a significantly higher proportion of eaters than skippers met the RDI or dietary target on the day of the survey for every nutrient
- The differences between eaters and skippers were particularly significant for thiamin, riboflavin, folate, calcium and magnesium, and also (for women only) iron, greater for older adults among whom the risk of an inadequate diet was significantly greater in breakfast skippers
- The proportion of skippers in the oldest age groups consuming less than 70% of the RDI was more than twice that of breakfast eaters for almost every nutrient, including protein
- Figures also showed for every nutrient, a higher proportion of breakfast cereal eaters had daily intakes above 70% of RDI than did those who did not eat breakfast cereal. Women (but not men) over the age of 25 years who included ready-to-eat cereal (RTEC) in their diets were also more likely to meet the dietary target of 30% energy from fat, than those who did not eat breakfast cereal (62% vs. 54%, P<0.05).

Author Conclusion:

- The study showed that the typical breakfast among Australian adults was low in fat, high in carbohydrate and a good source of thiamin, riboflavin, niacin, calcium and magnesium.
- The NNS showed that regular breakfast eaters had more adequate diets overall, particularly those aged 65+ years.
- People who did not eat breakfast cereal were much more likely to have inadequate nutrient intakes, especially of thiamin, riboflavin, calcium, magnesium and iron.
- Regular breakfast eaters were more likely to rate their health as excellent or good than those who skip breakfast, but there was no difference between the fat intake or the body mass index of regular breakfast eaters compared with breakfast skippers.
- Generally, regular breakfast consumption was associated with better diets for adults.

Reviewer Comments:

- *It was possible that the NNS results from 1995/1996 overestimated the current total vitamin A intakes and underestimate the folate and zinc intakes since there had been some significant changes to the fortification of Australian breakfast cereals since the NNS was carried out*
- *The results from the cross-sectional study suggested an association between breakfast consumption and better diet quality and health, but to determine whether it was the effect of breakfast per se, or other factors related to lifestyle, would need a controlled clinical trial.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions			
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)		Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?		Yes

3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	N/A
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	No
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes

5.1.		In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.		Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.		In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.		In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.		In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**		Yes
	6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
	6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
	6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A
	6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
	6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
	6.6.	Were extra or unplanned treatments described?	N/A
	6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
	6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**		Yes
	7.1.	Were primary and secondary endpoints described and relevant to the question?	N/A
	7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
	7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
	7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
	7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
	7.6.	Were other factors accounted for (measured) that could affect outcomes?	N/A
	7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**		Yes
	8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
	8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
	8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A

9.		**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.		**Is bias due to study's funding or sponsorship unlikely?**	Yes
	10.1.	Were sources of funding and investigators' affiliations described?	Yes
	10.2.	Was the study free from apparent conflict of interest?	Yes